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NATIONAL TRANSPORTATION SAFETY BOARD

AIRCRAFT ACCIDENT REPORT
JETCO AVIATION, INCORPORATED
SHORT BROTHERS & HARLAND, LTD.
SKYVAN SERIES 3 (SC-7), N21CK
WASHINGTON NATIONAL AIRPORT
WASHINGTON, D.C.
JULY 2, 1970

E. R. A. U. ...RY



NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
REPORT NUMBER : NTSB-AAR-71-6

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SA- None

File No. 3-0594

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JETCO AVIATION, INCORPORATED

SHORT BROTHERS & HARLAND, LTD.

SKYVAN SERIES 3 (SC-7), N21CK

WASHINGTON NATIONAL AIRPORT

WASHINGTON, D.C.

JULY 2, 1970

Adopted: January 13, 1971

NATIONAL TRANSPORTATION SAFETY BOARD

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: January 13, 1971

Jetco Aviation, Incorporated
Short Brothers & Harland, Ltd.
Skyvan Series 3 (SC-7), N21CK
Washington National Airport,
Washington, D. C.
July 2, 1970

SYNOPSIS

At approximately 10:48 am eastern daylight time on July 2, 1970, Short Brothers & Harland, Ltd., Skyvan Series 3, N21CK, operated by Jetco Aviation, Inc., Washington, D. C., as air taxi cargo flight, Flight 106, crashed during a VOR approach to Washington National Airport. The aircraft was demolished but did not burn. Both crewmembers received fatal injuries. There were no passengers.

According to witnesses, the aircraft was first visible to them, through fog and haze, when it was 700 to 800 feet above and about one-half mile out from the threshold of Runway 15.

Shortly after the aircraft came into view of the witnesses, it nosed down and rolled left until the wings were nearly vertical. The nosedown angle steepened progressively until it reached 45° or more. The aircraft struck the water of Roaches Run in this attitude, cartwheeled onto the right wingtip and sank in water 12 to 15 feet deep about 1,800 feet north of the threshold of Runway 15.

The Board determines that the probable cause of this accident was the loss of effective elevator control due to the forward shift of improperly secured cargo when the aircraft was placed in a steep nosedown attitude during a W-ing approach in reduced visibility conditions.

As a result of this investigation the Board recommends that:

The Federal Aviation Administration (FAA) take the necessary action to instruct all air taxi cargo operators to stow and secure their cargo in accordance with the provisions of Part 135.117 of the Federal Aviation Regulations and the manufacturer's specifications for the aircraft involved.

As a result of information obtained during this investigation, Short Brothers & Harland, Limited, Belfast, Northern Ireland, issued two Service Bulletins:

Service Bulletin No. 27-53 • Flying Controls:

To introduce a re-designed fork end fitting on the Anti-Up Float Spring Pot in Elevator Control Circuit.

Service Bulletin No. 25-56 - Equipment & Furnishings:

To fit guards at rear of 1st and 2nd Pilot's Seats.

INVESTIGATION

Jetco Aviation, Inc., Skyvan, Flight 106, N21CK, was completing the last leg of a point-to-point cargo flight that originated at Washington, D. C., at approximately 1730 1/ the previous day. Jetco Flight 106 was scheduled to depart John F. Kennedy International Airport (JFK), New York, at 0600, July 2, 1970; however, because of en route delays, departure from JFK was not until 0856. The flight was made in accordance with a visual flight rules (VFR) flight plan until it arrived in the vicinity of Atlantic City, New Jersey. The crew then air-filed an abbreviated instrument flight rules (IFR) flight plan and the flight was cleared to the Washington National Airport.

As Flight 106 approached Washington, D. C., the crew received clearance for a VOR 2/ approach to Runway 15 and at 1047:25, the tower controller at Washington National Airport (DCA) cleared the flight to land. He advised the crew that the surface wind was from 200° at 5 knots, and asked them if they had the airport in sight. At 1047:35, the crew replied, "Tower, not yet, we've got the Pentagon here." At 1047:55, the crew reported, "106 has the runway." This was the last communication from the aircraft and, 5 to 10 seconds later, the local controller and his assistant saw the aircraft at an estimated altitude of 500 feet. It was in a steep, diving bank to the left when it disappeared from their view.

The crewmembers were properly certificated and medically qualified for the performance of their duties. The copilot, a part-time pilot, was making his first trip with Jetco. The duty time for both pilots the preceding 24 hours was 13:18 hours. (For details, see Attachment 2)

The aircraft was properly certificated for the flight. N21CK, serial No. SH1858, was a cargo configuration of the Skyvan Series 3, Model SC-7, Variant 200, (For details, see Attachment 3.)

The maintenance records for the aircraft show that it had met the airworthiness standards in all maintenance categories except one; at the time of the accident, the aircraft had accumulated 111:86 hours since the last 100-hour inspection.

The aircraft fuel tanks were filled with jet fuel prior to the departure from John F. Kennedy International Airport.

The cargo floor in this type of aircraft contains 70 cargo-restraint fittings. Each fitting is designed for a load of 4,000 pounds. The cargo hold is 18 feet

1/ All times used herein are eastern daylight, based on the 24-hour clock.

2/ Very high frequency omnidirectional range. The landing minima for a VOR approach to Runway 15 are 700 feet ceiling and 1 mile visibility for propeller-driven aircraft.

7 inches long, 6 feet 6 inches wide, and 6 feet 6 inches high. There are seven seat-retaining rings on each side of the cargo compartment, which are not designed to restrain cargo. The front and rear rings are single and all the rest are double rings. Following the accident, tensile strength tests of these ring assemblies were made by the National Bureau of Standards. The tests revealed that failure occurs along the longitudinal axis of the bracket when a load of 1,330 pounds is applied. Failure occurs 45° to the longitudinal axis when a load of 400 pounds is applied.

The driver who delivered the New York cargo consignment to the aircraft later assisted the crew in loading some of the heavier boxes. The New York cargo weighed 2,766 pounds and was contained in 67 cartons and boxes. The driver noticed that some cargo had been previously loaded in the forward section of the cargo compartment. This cargo weighed 611 pounds and was contained in 29 boxes and cartons that were loaded on board at Boston. The driver said that most of the cargo he delivered was loaded on a "plywood" sheet, directly over cargo rollers, in the forward section of the cargo area, and the remainder was wedged along the sides. He saw the crewmembers tie down the cargo. He said they used one web-type nylon strap. One end of this strap was secured at a forward point on the left sidewall of the cabin. The other end was placed around the rear of the cargo and secured to a point on the right rear sidewall of the cabin. A crewmember then used a ratchet to tighten the strap at the right side point.

The 1029 surface weather observations, taken at Washington National Airport prior to the accident, were:

Estimated ceiling 8,000 feet overcast, visibility 24 miles, fog, haze; wind from 200°, 5 knots, altimeter setting 29.94.

The 1057 reported Washington National Airport weather observation was as follows:

Estimated ceiling 8,000 feet overcast, visibility 24 miles, fog, haze; temperature 77° F., dew point 73° F., wind from 180°, 5 knots, altimeter setting 29.94.

Runway 15 at Washington National Airport is 5,212 feet long and 200 feet wide. Runway 15 has high-intensity runway lights, runway end identifier lights, and a Visual Approach Slope Indicator (VASI). All field lights were on at full brightness.

The airport elevation is 15 feet m.s.l.^{3/} The distance from the end of Runway 15 to the Pentagon is 0.8 nautical miles. (See Attachment 4.)

The flightpath of the aircraft at impact was approximately 50° magnetic. The center point of the wreckage area was located about 240 feet from the nearest shore under 12 to 15 feet of water. Approximately 95 percent of the aircraft was

^{3/} Mean sea level.

salvaged from a circular area in the water about 170 feet in diameter. Missing items included the copilot's seat, some instruments, both flight control columns, and some small pieces of fuselage skin.

All of the recovered trim control cables sustained tension failures. All of the turnbuckles were intact and safety wired. The elevator trim actuator was 1° down (1° noseup trim). The total trim available was 5° noseup and 4° nosedown.

The right wing was recovered practically intact but without the engine and nacelle. The aileron and two sections of flap were attached to the wing. The flap was partially extended. Measurements of the flap actuator in the aircraft were compared with measurements of a similar aircraft with the flaps in various positions. These comparisons indicated that the flaps on Flight 106 were extended 50° (full down) at impact. The right flap impact mark on the fuselage measured 50°. Both wing flaps are operated by one actuator, and the position of one flap corresponds mechanically to the position of the other flap.

The left wing was recovered in two pieces. One piece, the inboard quarter behind the main spar, had a section of flap attached. The other piece comprised the remainder of the wing, less the aileron and the engine. The left engine had separated from the wing at the main mounts.

The right side of the empennage was essentially intact. The left vertical stabilizer, left rudder, and left side of the elevator had separated from the empennage, but were recovered.

The nose section, the pilot's half of the cockpit, and the entire left side of the fuselage were fragmented. The right side of the fuselage, including the top of the copilot's entrance door, showed four slashmarks. The pilot's entrance door, the ditching hatch, and the rear cargo doors were recovered. The cargo floor was examined, and all cargo restraint rings were found to be intact except for two on the left side where the floor was broken. None of the cargo restraint rings had cargo strap hooks attached, nor was there any evidence that any had been attached. Four cargo rollers and a ½-inch thick pressed-wood pallet were recovered. Two of the rollers were each 10 feet long and two were 5 feet long.

Seven nylon cargo straps were aboard the aircraft at impact. These were recovered and none of the straps was broken. Cargo nets were not used on this flight.

One cargo strap hook had a single fuselage seat-storage ring attached and another strap hook had double fuselage seat-storage rings attached. These two straps were wrapped about each other when salvaged.

Of the five remaining straps, one that was compactly rolled was found lodged under the pilot's seat. The other four were loose with all locking and ratchet mechanisms and hooks intact.

The engines and propellers were examined under NTSB cognizance at the Aire-search plant at Phoenix, Arizona. This examination showed that both engines were rotating at impact and that both propellers were set for landing approach power.

No evidence was found that would indicate any preimpact malfunction or failure of the aircraft systems that could be related to the cause of the accident.

The entire flight control system was recovered, including all the push-pull rods and rod end fittings in the empennage. All breaks were typical of breaks resulting from gross bending and tension overloads. The elevator anti-up float spring pot assembly was still attached to the fuselage attaching structure. However, the clevis end of this assembly was separated in the threaded section with the clevis end attached to its respective bell crank. The fractured ends showed preimpact fatigue cracks on the top and bottomsides through approximately 20 percent of the cross-sectional area. The cracks were typical of fairly low cycle, high-stress type fatigue propagation. This assembly supplies artificial "feel" of elevator control force to the pilot in the last 30 percent of up-elevator travel, and its eventual failure would not affect the controllability of the aircraft.

The accident was nonsurvivable. Autopsies showed that both pilots sustained fatal injuries as the result of impact.

The maximum certificated takeoff and landing weight for the aircraft is 12,499 pounds. The following computations relate to the weight and balance of N21CK on departure from JFK, using actual weights:

Aircraft basic weight	7,778	pounds
Crew	375	"
Flight bags	40	"
Fuel	2,260	"
Cargo	3,412	"
Miscellaneous equipment	259	"
Total weight at takeoff	14,124	"
Estimated fuel burnoff	• 934	" (@ 500 lbs./hr.)
Estimated aircraft gross weight at time of crash	13,190	pounds

The aircraft was about 1,600 pounds overweight for takeoff; however, the manufacturer states that "experience has shown that this in itself would not be dangerous although performances after an engine failure would be marginal."

The maximum trimmable center of gravity limit forward is 10 percent of the mean aerodynamic chord (MAC) ahead of the forward center of gravity limit. Beyond this point, the aircraft is uncontrollable. The computed center of gravity for the aircraft at takeoff was 2.30% forward of the forward limit. The manufacturer states, "Although wrongly loaded this is still well within the trimmable range."

ANALYSIS AND SUMMARY

Investigation of the aircraft, engines, systems, and aircraft records indicated that there were no mechanical malfunctions or failures of the aircraft that could be related to the probable cause of the accident.

Air Traffic Control functions were properly executed as they related to Flight 106, and there was no evidence of any equipment or navigational facility malfunctions.

The reported visibility was $2\frac{1}{2}$ miles with fog and haze; however, there is evidence that the crew did not see Runway 15 until the aircraft had approached to within about one-half mile, or less, from the end of the runway. They did *not* have the runway in sight in the vicinity of the Pentagon, which is 0.8 nautical mile from the end of the runway.

The landing minima on this approach to Runway 15 is ceiling 700 feet and one mile visibility, requiring that the pilot maintain a minimum m.s.l. altitude of 715 feet until the runway is in sight. This would account for the high approach altitude which ground witnesses observed and estimated to be between 700 and 800 feet.

The cargo floor of the aircraft was adequate for cargo tiedown; however, the cargo was *not* secured in accordance with approved procedure. There were no cargo nets aboard. None of the cargo straps was anchored to the floor tiedown rings either fore and aft or from side to side over the load. (See Attachment 8.) The cargo tiedown straps used were attached to a forward sidewall seat-retaining ring, placed around the rear of the load, and attached to an aft sidewall seat-retaining ring.

Assuming that the pilot was flying at about 700 feet altitude at one-half a mile out, it would be necessary for him to descend at a rate of at least 2,100 feet per minute (f.p.m.), on a glide slope of about 13° to be in proper landing position over the runway. A normal rate of descent for a standard landing glide slope of 3° is about 400 f.p.m.

A STOL aircraft, such as the Skyvan, is capable of making a steep glide slope final approach to a runway due to its high lift features. However, in order to make good a 13° glide slope, the deck angle of the aircraft must be changed drastically. Initially, the power is reduced to idle and the pilot then lowers the flaps to full down. This maneuver, which combines a steep nosedown attitude, full flaps, and the drag from the propellers would have caused forward longitudinal forces to be exerted on the 96 boxes and cartons in the cargo hold. If this cargo were not properly restrained from these forward forces, it would progress forward, moving the aircraft center of gravity accordingly. As the center of gravity moved beyond its forward controllable limit, effective elevator control would be lost. (See Attachment 5.) Witness descriptions of the aircraft's nose dropping down through a 45° angle indicate that a progressive control loss of this type occurred.

Probable Cause

The Board determines that the probable cause of this accident was the loss of effective elevator control due to the forward shift of improperly secured cargo when the aircraft was placed in a steep nosedown attitude during a landing approach in reduced visibility conditions.

Recommendations

As a result of this investigation the Board recommends that:

The Federal Aviation Administration (FAA) take the necessary action to instruct all air taxi cargo operators to stow and secure their cargo in accordance with the provisions of Part 135.117 of the Federal Aviation Regulations and the manufacturer's specifications for the aircraft involved.

Corrective Actions

As a result of information obtained during this investigation, Short Brothers & Harland, Limited, Belfast, Northern Ireland, issued two Service Bulletins.

Service Bulletin No. 27-53 - Flying Controls:

To introduce a redesigned fork end fitting on the Anti-Up Float Spring Pot in Elevator Control Circuit. (See Attachment 6.)

Service Bulletin No. 25-56 - Equipment & Furnishings:

To fit guards at rear of 1st and 2nd Pilot's Seats. (See Attachment 7.)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

January 13, 1971

INVESTIGATION AND HEARING

1. Investigation

The Board received notification of the accident at 1102 a.d.t. on July 2, 1970. The Investigator-in-Charge was dispatched immediately to the scene from the Washington Field Office at Dulles International Airport, with technical assistance from Washington, D. C. Working groups were established for operations, witnesses, air traffic control, structures, powerplants, aircraft and maintenance records, systems, and human factors. Parties to the investigation were Jetco Aviation, Inc., the Federal Aviation Administration, Short Brothers & Harland, Ltd., the Garrett Corporation, and Airesearch Manufacturing Company. The on-scene phase of the investigation was completed in about 9 days due to the need for underwater salvage operations. Tests and failure analysis of specific aircraft parts were conducted at the Safety Board headquarters and at the National Bureau of Standards. The engines were examined at the Airesearch Mfg. Co. plant at Phoenix, Arizona.

2. Hearing

There was no public hearing.

3. Preliminary Reports

An interim report of investigation summarizing the facts disclosed by the first phase of the investigation was published on September 14, 1970.

20. PILOT HISTORY

A. Pilot-in-Command

NAME AND ADDRESS Louis John Weihs, Jr. 2215 West Ialoma Dr. Rancho Cordova, Calif. 95670	DATE OF BIRTH 3/31/24	NATIONALITY USA	SEAT OCCUPIED IF	REG. AND D.O. NO. OF RESIDENCE 4
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FAA PILOT CERTIFICATE HELD

FAA MEDICAL CERTIFICATE

CERTIFICATE NO. 53714	DATE OF ISSUE 6/2/67	INSTRUMENT TRAINING PRIOR TO SOLO	YES NO	BLUE SEAL	YES NO	DATE OF ISSUE 6/10/70
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<input checked="" type="checkbox"/> AIRLINE TRANSPORT	RATINGS AND LIMITATIONS		CLASS
<input type="checkbox"/> COMMERCIAL	<input checked="" type="checkbox"/> AIRPLANE	<input checked="" type="checkbox"/> MULTI ENGINE LAND	<input checked="" type="checkbox"/> FIRST <input type="checkbox"/> SECOND <input type="checkbox"/> THIRD
<input checked="" type="checkbox"/> FLIGHT INSTRUCTOR	<input type="checkbox"/> ROTORCRAFT	<input type="checkbox"/> MULTI ENGINE SEA	LIMITATIONS
<input type="checkbox"/> PRIVATE	<input type="checkbox"/> GLIDER	<input checked="" type="checkbox"/> SINGLE ENGINE LAND	None
<input type="checkbox"/> STUDENT	<input type="checkbox"/> INSTRUMENT	<input checked="" type="checkbox"/> SINGLE ENGINE SEA	
OTHER (Specify)	OTHER (Specify) TYPE RATINGS DC-3, CV 240/3401 4401, C-46 Lexv 33124		PATHOLOGICAL AND/OR TOXICOLOGICAL EXAMINATION PERFORMED <input type="checkbox"/> NO <input checked="" type="checkbox"/> YES (Extent) P & T

PILOT FLIGHT TIME (To nearest hour)	SOURCE OF INFO. <input checked="" type="checkbox"/>	PILOT'S FLT. LOG	FAA RECORDS	OPERATOR'S ESTIMATE	OTHER (Specify)
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TYPE	LAST 24 HOURS		LAST 90 DAYS			TO DATE		
	DUAL	SOLO	DUAL	SOLO	TOTAL	DUAL	SOLO	TOTAL
(1) THIS MAKE AND MODEL		7:30		44:00	51:30	20:18	84:40	107:58
(2) NIGHT				27:12	27:12			1626:42
(3) DAY				26:30	26:30			8654:18
(4) INSTRUMENT	ACTUAL			9:00	9:00			1000:00
	SIMULATED							
(5) SINGLE ENGINE				2:12	2:12			500:00
(6) MULTI ENGINE					51:30			9772:00
(7) ROTORCRAFT								
(8) GLIDER								
TOTAL (5, 6, 7, 8)					53:42			10272:00

B. Second Pilot

NAME AND ADDRESS Robert Gilmour Williams 8700 Colwyn Road Oxen Hill, Maryland	DATE OF BIRTH 4/25/35	NATIONALITY USA	SEAT OCCUPIED RF	REG. AND D.O. NO. OF RESIDENCE
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FAA PILOT CERTIFICATE HELD

FAA MEDICAL CERTIFICATE

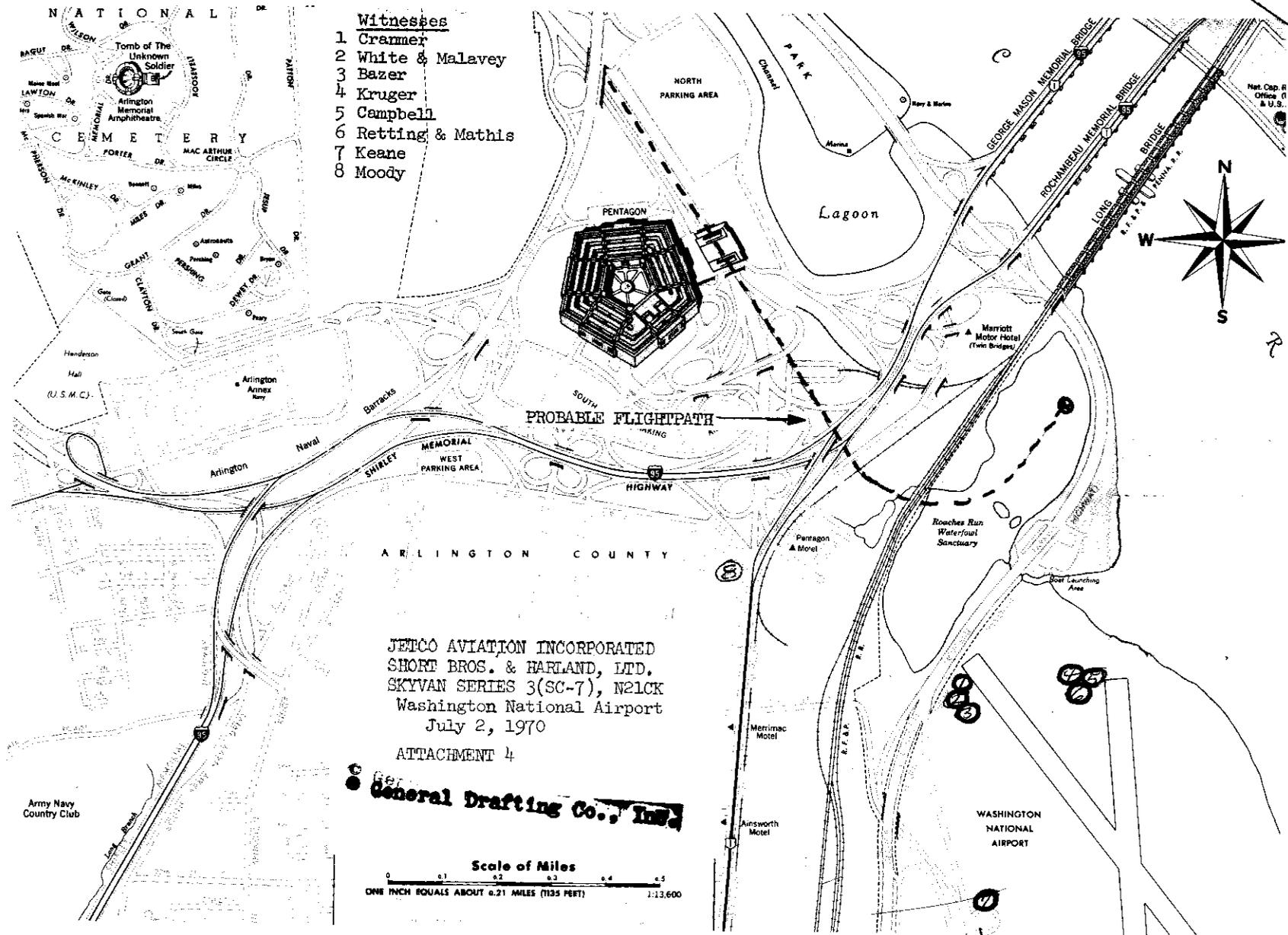
CERTIFICATE NO. 1718403	DATE OF ISSUE 5/3/68	INSTRUMENT TRAINING PRIOR TO SOLO	YES NO	BLUE SEAL	YES NO	DATE OF ISSUE 12/2/69
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<input checked="" type="checkbox"/> AIRLINE TRANSPORT	RATINGS AND LIMITATIONS		CLASS
<input checked="" type="checkbox"/> COMMERCIAL	<input checked="" type="checkbox"/> AIRPLANE	<input checked="" type="checkbox"/> MULTI ENGINE LAND	<input checked="" type="checkbox"/> FIRST <input type="checkbox"/> SECOND <input type="checkbox"/> THIRD
<input checked="" type="checkbox"/> FLIGHT INSTRUCTOR	<input type="checkbox"/> ROTORCRAFT	<input type="checkbox"/> MULTI ENGINE SEA	LIMITATIONS
<input type="checkbox"/> PRIVATE	<input type="checkbox"/> GLIDER	<input checked="" type="checkbox"/> SINGLE ENGINE LAND	None
<input type="checkbox"/> STUDENT	<input checked="" type="checkbox"/> INSTRUMENT	<input type="checkbox"/> SINGLE-ENGINE SEA	
OTHER (Specify)	OTHER (Specify) TYPE RATINGS		PATHOLOGICAL AND/OR TOXICOLOGICAL EXAMINATION PERFORMED <input type="checkbox"/> NO <input checked="" type="checkbox"/> YES (Extent) P & T

PILOT FLIGHT TIME (To nearest hour)	SOURCE OF INFO. <input checked="" type="checkbox"/>	PILOT'S FLT. LOG	FAA RECORDS	OPERATOR'S ESTIMATE	OTHER (Specify)
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TYPE	LAST 24 HOURS		LAST 90 DAYS			TO DATE		
	DUAL	SOLO	DUAL	SOLO	TOTAL	DUAL	SOLO	TOTAL
(1) THIS MAKE AND MODEL	7:30	0	0	0	0	7:30		7:30
(2) NIGHT	4:06	0	10:42	0	10:42			150:54
(3) DAY	3:44	0	22:54	0	22:54			709:12
(4) INSTRUMENT	ACTUAL	0	0	0	0			16:42
	SIMULATED	0	0	0	0			46:36
(5) SINGLE ENGINE	0	0	26:16	1	27:06			816:54
(6) MULTI ENGINE	7:30	0	7:30	0	7:30			43:12
(7) ROTORCRAFT	0	0	0	0	0			0
(8) GLIDER	0	0	0	0	0			0
TOTAL (5, 6, 7, 8)	7:30	0			28:06			860:06

21. AIRCRAFT HISTORY				SOURCE OF INFORMATION			
MAKE Short Bros. & Harland LTD.				MODEL Skyvan SC-7			
SERIAL NO. SH 1858				REGISTRATION MARK N 21CK			
AIRWORTHINESS CERTIFICATE							
ISSUANCE DATE 6/18/69	TYPE X	NORMAL UTILITY ACROBATIC	TRANSPORT	PROVISIONAL	RESTRICTED	LIMITED	EXPERIMENTAL
TOTAL TIME 701-0	TIME SINCE OVERHAUL new	TYPE OF MAINTENANCE PROGRESSIVE		LAST INSPECTION TYPE DATE 6/13/70			
DATE OF LAST PERIODIC INSPECTION 6/13/70		PERIODIC (Give date of last inspection)		annual		AIRC. HOURS AT TIME OF INSPECTION 589.14	
ENGINES							
NO.	MAKE AND MODEL	SERIAL NO.	TIME			TYPE OF INSPECTION	
			TOTAL	SINCE OVERHAUL	SINCE LAST INSPECTION		
1	Garrett Airesearch TPE 331-2-201A	P90047	701.0	701.0	111.86	annual	
2	TPE 331-2-201A	P90045	1183.4	183.4	111.86	annual	
PROPELLERS/ROTORS							
NO.	MAKE AND MODEL	SERIAL NO.	TIME SINCE NEW OR OVERHAUL				
1	Hartzell HC-BeIN-5C/T 10282 HB	BV 469	701.0				
2		BV 465	701.0				
RADIO EQUIPMENT INSTALLED							
RECEIVERS						TRANSMITTERS	
VOR	ILS	ADF/DF	MARKER BEACON	OTHER (Identify)		VHF	OTHER (Identify)
VHF	DME	LF/MF	RADAR			LF/MF	
FLIGHT INSTRUMENTS INSTALLED			ELECT.	VACUUM	DEICER EQUIPMENT INSTALLED		
COMPASS			X		NONE	TYPE	
TURN AND BANK			X		X	PROPELLER DEICERS	
ALTIMETER	2			X	X	WING DEICERS	
AIRSPEED INDICATOR	2					N/A	L/E
ATTITUDE INDICATOR	2				X	EMPENNAGE DEICERS	
DIRECTIONAL GYRO	2	X			X	WINDSHIELD DEICERS	
RATE OF CLIMB	2			X	X	WINDSHIELD WIPERS	
CLOCK	1					PITOT HEATER	
INTEGRATED FLIGHT SYSTEM	N/A					FUEL TANK VENT HEATER	
AUTOPILOT	N/A					N/A	
APPROACH COUPLER	N/A					MISCELLANEOUS EQUIPMENT INSTALLED	
ALTITUDE CONTROL	N/A				X	NAVIGATION LIGHTS	
FLIGHT RECORDER	N/A				X	LANDING LIGHTS	
STALL WARNING INDICATOR					X	ANTI-COLLISION LIGHTS	
SAFE FLIGHT INDICATOR	N/A				X	INSTRUMENT LIGHTS	
OTHER (Identify)						FLARES	
					X	FLASHLIGHT	
						No	
						2 aboard & found	
						LANDING GEAR INDICATOR	
						N/A	
22. COLLISION ACCIDENTS							
(For mid-air collisions, a separate NTSB Form 6120.4 is required for each aircraft involved, and a NTSB Form 6120.4A.)							
OTHER AIRCRAFT INVOLVED				NAME AND ADDRESS OF OWNER			
MAKE AND MODEL							
REGISTRATION MARK N							
23. NARRATIVE STATEMENT OF FACTS, CONDITIONS, AND CIRCUMSTANCES SURROUNDING ACCIDENT (Give a concise, chronological sequence of events and detail the environmental conditions at the time of occurrence)							



Witnesses

- 1 Cramer
- 2 White & Malavey
- 3 Bazer
- 4 Kruger
- 5 Campbell
- 6 Retting & Mathis
- 7 Keane
- 8 Moody

ARLINGTON COUNTY

JETCO AVIATION INCORPORATED
 SHORT BROS. & HARLAND, LTD.
 SKYVAN SERIES 3(SC-7), N21CK
 Washington National Airport
 July 2, 1970

ATTACHMENT 4

General Drafting Co., Inc.

Scale of Miles

0 0.1 0.2 0.3 0.4 0.5
 ONE INCH EQUALS ABOUT 0.21 MILES (1325 FEET) 1:13,600

SKYVAN - N21CKACCIDENT AT WASHINGTON, D. C.Note on Weight and Balance

Short Brothers & Harland Ltd., Belfast, Ireland, manufacturers of SKYVAN N21CK, prepared an analysis of the weight and balance conditions involved in the crash of Flight 106. The report of this analysis contains the following computed conditions:

Estimate of effect of cargo shift

Assume main cargo package becomes dismantled due to acceleration caused by deceleration of aircraft and moves as predicted.

Aircraft on approach	13221	↗ 0.746	↗ 9865
Take out main payload	2766	↘ 1.170	↘ 3236
Take out fwd. payload	611	- 5.17	- 3159
	<u>9844</u>	<u> </u>	<u>↗ 9788</u>
Add displaced main payload	2766	- 2.25	- 6224
Add displaced fwd. payload	611	- 5.58	- 3409
	<u> </u>	<u> </u>	<u> </u>
Aircraft in final condition	13221	↘ 0.012 (0.21%)	↗ 155

After assumed cargo shift

The aircraft was now down to 13221 lb. and the amount of overweight was 721 lb. which would scarcely have been noticeable.

With a CG arm of 0.012 ft. the CG was $0.833 - 0.012 = 0.821$ ft. (9.85 ins.) forward of the normal forward **limit** or, $\frac{0.821 \times 100}{5.833}$

= 14.1% **SMC** forward of forward **limit**. This is outside the trimmable forward **limit** which is 10% **SMC** forward of the normal.

SHORTS

SERVICE BULLETIN

NUMBER 27 - 53

Flying Controls: To introduce a re-designed fork end fitting on the Anti-Up Float Spring Pot in Elevator Control Circuit.

Modification No. 1080

1. Planning Information

- | | | |
|---|---------------------------------------|--|
| A | <u>Effectivity</u> | Skyvan Series 3 |
| B | <u>Reason</u> | Evidence of a premature fatigue has been reported. |
| C | <u>Description</u> | The fork end fitting on the spring pot has been re-designed in steel. |
| D | <u>Compliance</u> | Recommended. |
| E | <u>Approval</u> | This modification and the technical contents of this Bulletin which affect air-worthiness have been approved under the authority of the Air Registration Board Design Approval No. AD/1023/45. |
| F | <u>Manpower</u> | 4 Man Hours. |
| G | <u>Material Cost and availability</u> | Modification Kit No. 27-53 is required to accomplish this modification. The price of the kit is €19.00 and may be obtained from: |

Skyvan Co-Ordinator
Product Support Department
Short Brothers & Harland Ltd
Queen's Island
BELFAST BT3 9DZ

This offer is available for three months after receipt of this Bulletin.

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Telegrams: AIRCRAFT BELFAST

Telephone: BELFAST 58444

Telex: 74688

SHORTS SERVICE BULLETIN

N U M B E R 27 - 53

Flying Controls: To introduce a re-designed fork end fitting on the Anti-up Float Spring Pot in Elevator Control Circuit.

Modification No. 1080

1. Planning Information (Cont'd.)

H Tooling	No special tooling is required for this modification.
I <u>Weight & Balance</u>	Weight change t0.1 lb. Moment change t2 lb/ft
J <u>References</u>	<u>ILLUSTRATED PARTS Catalogue</u> Chap. 27-10 Fig.12

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SHORTS SERVICE BULLETIN

N U M B E R 2 5 - 5 6

Equipment & Furnishing: To fit guards at rear of 1st and 2nd Pilot's Seats.

Modification No. 1086

1. Planning Information

- A Effectivity Skyvan Series 3
- B Reason To ensure that mechanical controls in pilot's seat pedestal are fully guarded.
- C Description Fit guard under seat frame SC7-16-160 at rear of seat and cover 2 flanged holes in seat back.
- D Compliance Recommended.
- E Approval This mod has been approved by the Air Registration Board and the technical contents of this Bulletin affecting air-worthiness has been approved under the authority of the Air Registration Board Design Approval No. AD/1023/45.
- F Manpower 5 Man Hours.
- G Material Cost and Availability Mod Kit 25-56 is required to accomplish this mod. The price of the kit is f21.34 and is available for three months after receipt of this Bulletin. Orders for kits should be addressed to:

Skyvan Co-Ordinator
 Product Support Department
 Short Brothers & Harland Ltd
 P.O. Box 241
 Queen's Island
 BELFAST BT3 9DZ

Original Issue: Nov. 23/70

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SHORTS

SERVICE BULLETIN

NUMBER 25-56

Equipment & Furnishing: To fit guards at rear of 1st and 2nd Pilot's Seats..

Modification No. 1086

1. Planning Information (Cont'd.)

H <u>Tooling</u>	No special tooling required.
I <u>Weight & Balance</u>	Weight change + .5 lb. Moment change - 4 lb.ft.
J <u>Reference</u>	Illustrated Parts Catalogue Chapter 25.10 Fig 2 and 3.

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CARGO RESTRAINT

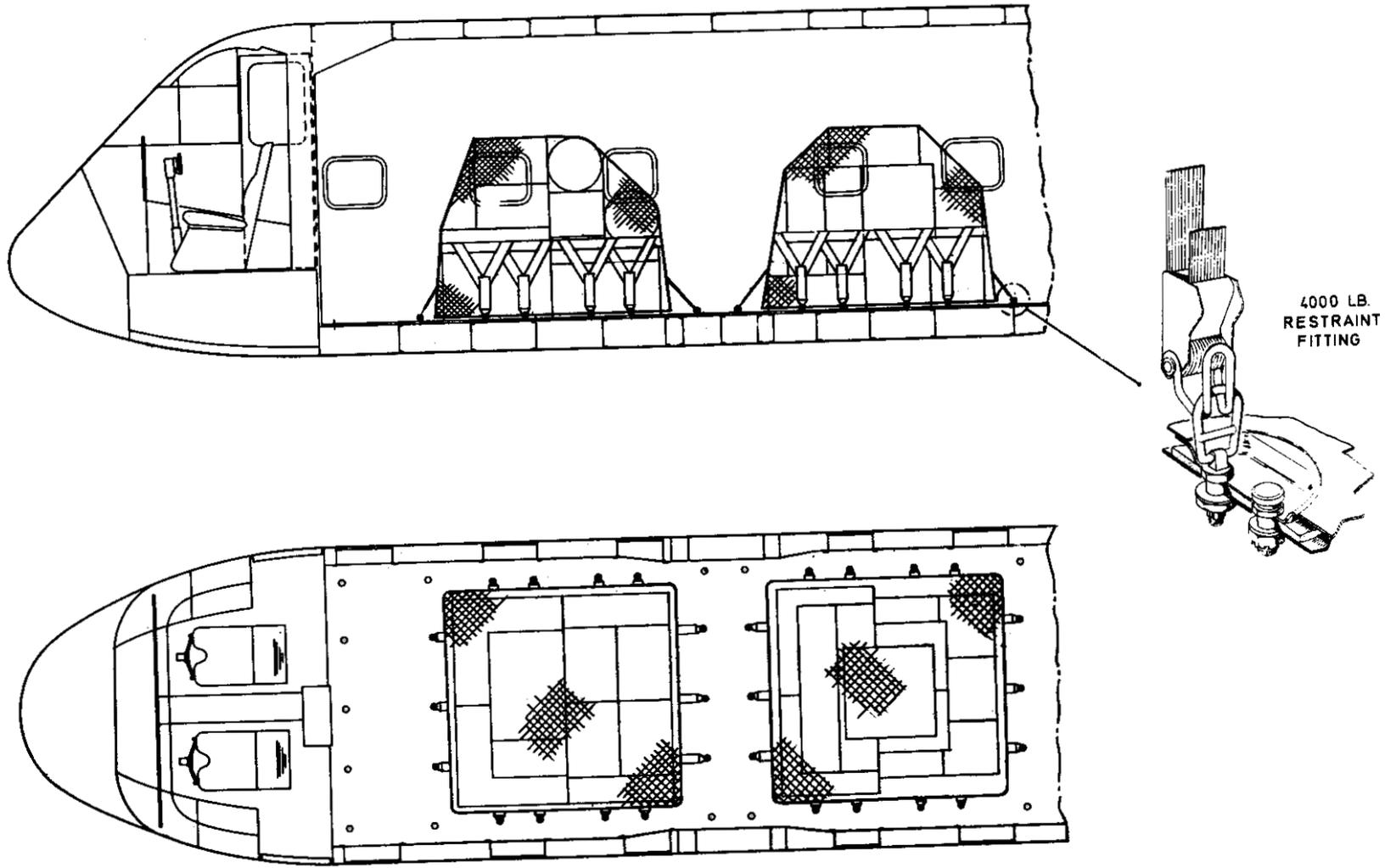


FIG. 18.3.
Sept. 67

SE D 158A

VEHICLE RESTRAINT

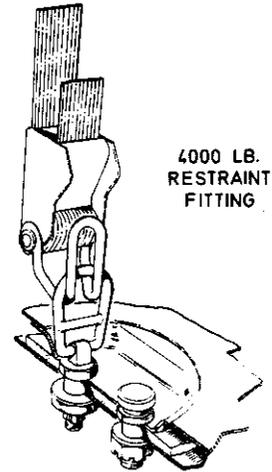
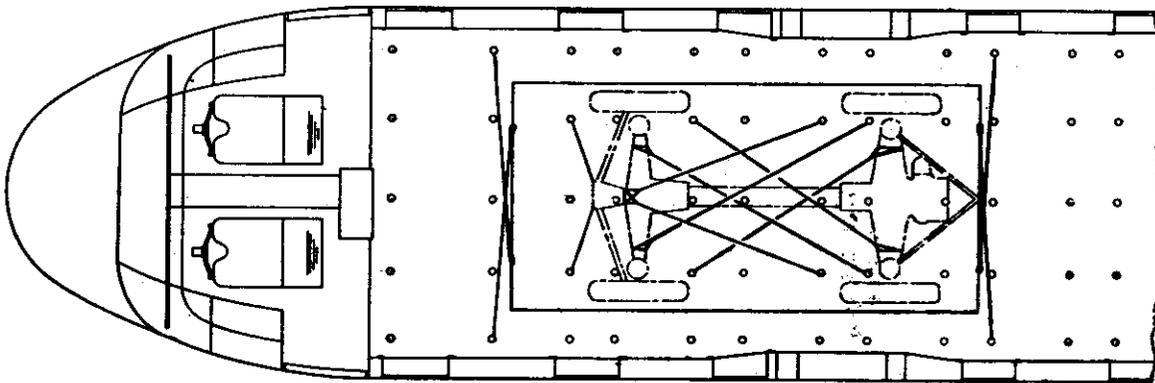
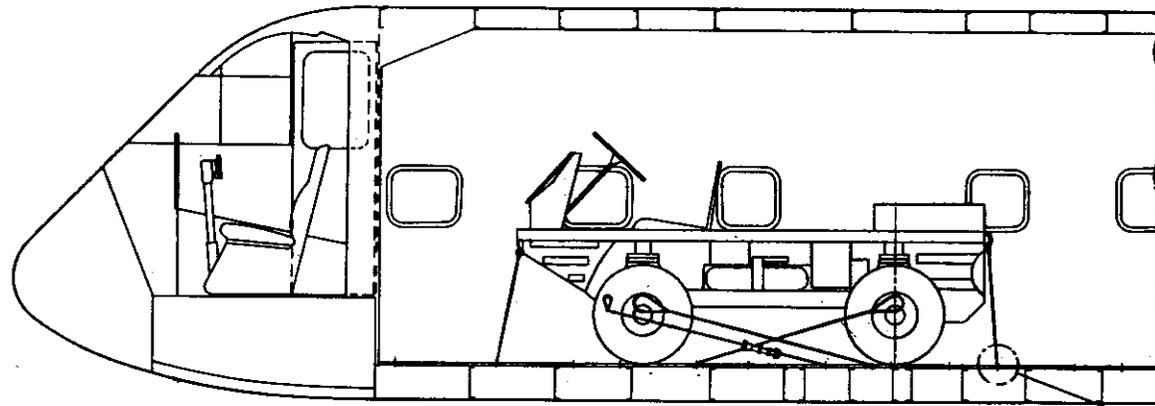


FIG. 18.4.
Sept. '67.